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ABSTRACT

The early work experiences of graduates of Michigan State University's engineering program who did and did not participate in the university's cooperative education program were compared. A two-part survey that covered work experiences during college, skill development in undergraduate programs, career evaluation and outlook, demographic information, initial and present job, and intermittent job changes and/or promotions was mailed to a total of 2,106 engineers who had received their degrees between 1979 and 1990. Of the 609 surveys returned, 600 included work diaries complete enough to be analyzed. The distribution of respondents across engineering disciplines accurately reflected the enrollment and graduation patterns reported by the engineering college. Approximately 21% of the respondents had not obtained engineering-related work experience during their undergraduate years. Of those who had obtained work experience, 35% had been cooperative education program participants, 31% gained experience through summer employment, and 13% participated in internships. Participation in cooperative education was associated with a salary advantage over all the time periods studied; however, the salary gap between program participants and nonparticipants appeared to be closing. Cooperative education experience appeared to have little effect on career progress (promotions) in comparison with other work experiences. (MN)

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more alike than different:

early work experiences of co-op and non co-op engineers

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College of Engineering

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The Collegiate Employment Research Institute was established to serve post-secondary institutions in Michigan through research activities on issues relevant to the transition of college graduates from college to the world of work. Research covers topics in career planning, employment outlooks, career development, and recruitment. Information is distributed to students, faculty, placement professionals and administrators via newsletters, research reports and special bulletins. We hope to improve the flow of information on careers and work so that college students can be aware of the options before them.

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More Alike Than Different:

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College students are inundated with messages from career counselors and employers on the need for career related work experiences gained prior to graduation. No better way exists to gain these experiences, some argue, than through experiential learning, such as cooperative education. It is expected and emphasized that these experiences will ease the transition from college to employment.

Recent studies have examined the transition from college to the workplace and revealed that co-op participation has (1) allowed students with no previous work experience to enhance their salary to levels equivalent with students having work experience (Siedenberg, 1990); (2) propelled starting salaries of co-op graduates over graduates with similar academic preparation (Gardner et al, 1992); and (3) facilitated early socialization into the work place (Gardner and Kozlowski, 1993). Co-op participation clearly has decided advantages that can influence early work experiences.

The unanswered question centers on whether these advantages persist after entry into the workforce. Cowan (1992) suggests from information he reviewed that new engineers are treated very much alike during their first five years on the job. About the fifth year, a few engineers are selected for promotion into management while the others scurry to obtain new skills to remain on their career paths. This scenario can be

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further confounded by recent changes in the labor market which have greatly altered the hierarchical structure of the workplace and redefined the work relationships and labor contracts that previously existed (Boyett and Conn, 1991). Whether bounded by a fraternal initiation system or tossed by the winds of change, new labor market entrants face challenges as they strive to meet their career aspirations. Does the co-op experience mitigate these possible career path disruptions and provide the boost someone needs to move along their chosen career path?

Once employment has been engaged, co-op experiences may continue to influence career advancement by accelerating promotions and salary increases. Or they can be offset by other experiences and factors related to the work place, such as workplace learning or the informal power structures (politics) of the organization. Little is known about the impact of the co-op experience on participants' early careers. This report presents findings from a recent study that probed into the early career patterns of a group of engineers to determine if the co-op experience had any sustained influence on organizational change, salary and career patterns.

Participants and Study Approach

To capture early employment patterns of recent graduates, engineers who received degrees from Michigan State University between 1979 and 1990 were selected for this study. This particular group of students was targeted because this was the only academic program on campus with a formal co-op program. Two separate samples were drawn. The first group was comprised of graduates whose starting salary information (reported to the University's placement office) had been used in our study of starting salaries (Gardner, Nixon and Motschenbacher, 1992). This group was augmented by including all remaining co-op students from 1979 to 1989 who had not been included in the earlier study. Valid addresses were provided by the alumni office for 1196 members of this group.

The second group consisted of graduates who had not been included in the first study population (i.e. those who failed to respond to the placement office's follow-up survey and those who had gone directly to graduate school) and members of the 1990 graduating classes. The 1990 graduates served as a benchmark to determine if recall problems might exist with information on first job experiences obtained from those who had been in the work force longer. Valid addresses were obtained for 910 members of this group.

Participants were administered a survey adapted from Nicholson's and West's (1988) study of managerial job change. The instrument consisted of two parts: (1) review of work experiences while in college, skill development in undergraduate programs, career evaluation and outlook, and demographic information; and (2) a detailed work diary, emphasizing their first job, their current job, and three intermittent job changes (promotions or responsibilities). For each position, information was sought on the graduate's level within the organization, job title, salary, and selected attitudes and perceptions about the work environment. The diary concluded with a job summary that counted the number of organizations, promotions, job changes, and shifts in job responsibilities each graduate had experienced.

Respondent Profile

A total of 409 returns were received from group one (34 percent response rate) and 200 returns from group two (22 percent response rate) for a total of 609 returns. Of the returned surveys, 600 diaries were complete enough to be used in the analyses. Missing data, causing the number of observations in some analyses to vary, appeared to be random and did not inject bias into the analyses.

Sixty-eight percent (68) of the respondents were men. The median age was 31 years, ranging from 25 to 40. Approximately 65 percent were married or living with a partner; 32 percent were single; and for the remainder their marital status was in transition. Two-hundred twenty-seven (38 percent) reported having children.

For 70 percent of the respondents their bachelor's degree in engineering was the highest level of education attained. One-hundred and two (17 percent) had earned a master's degree in engineering, 59 (10 percent) a master's in business administration (MBA), and 17 (3 percent) received doctoral degrees or degrees in law or medicine.

The distribution of respondents across engineering disciplines accurately reflected the enrollment and graduation patterns reported by the engineering college. Mechanical engineering accounted for 27 percent of the respondents. Civil and electrical engineering followed with 16 percent each, while chemical engineering, computer science and engineering arts accounted for 11 percent each. Two smaller programs were agricultural engineering (3 percent) and a group which included material science, mechanics and operations research (3 percent).

Approximately 21 percent (n=126) of the respondents indicated that they had obtained no engineering-related work experience during their undergraduate years. For those with work experience, 35 percent had been co-ops participants (n=210); 31 percent (n=183) had gained experience through summer employment; and 13 percent (n=80) utilized internships. Approximately 70 respondents indicated they had two or more different work experiences (i.e. co-op and summer employment). These respondents were

classified by giving co-op top priority, followed by internships.

In the analyses that follow, the co-op group was subdivided into two groups: those with two or fewer co-op terms (n=74) and those with three or more (n=146). Three co-op experiences comprised a one year or complete co-op commitment. This division was found to be significant in our earlier study and was assumed to be important in this study.

The summer employment group contained engineers who had participated in a special automobile industry program which was terminated in the early 1980s. The internship experience, an informal arrangement between the student and the employer and usually brokered by a faculty member or through the Career Development and Placement Office, is a recent development. Most internship experiences have occurred since 1987 and have been particularly popular among computer science and mechanical engineering students.

Employment Overview

In summarizing their careers, respondents provided the number of companies they worked for, the number of promotions they received, the number of job changes not considered as promotions, and the number of times job responsibilities were altered even though a change in jobs did not occur.

While the number of organizations ranged from one to eight, 32 percent of the respondents were still with the company that hired them upon graduation. The average, therefore, was low, only 1.87 organizations. Approximately 19 percent of the respondents had not received a promotion while 22 percent had received one; thus leaving 59 percent promoted at least twice. The number of promotions ranged from 0 to 10 with an average of 2.17.

Numerous respondents were involved in job changes that did not result in a promotion (62 percent of those who answered this question) and in restructured job responsibilities (55 percent of those who answered). In these cases, respondents encountered only a few changes. However, multiple job shifts within a company were rather common for some.

Comparisons were made between work experience groups, using ANOVA tests, to determine any differences. Co-op participants did not differ from the other groups on any of these employment characteristics. Length of time in the labor force explained most of the differences. Those who entered the workforce prior to 1982 had worked for more organizations, had received more promotions, and had made more job changes than those who entered more recently. No differences appeared, however, for changes in responsibilities; everyone had experienced a similar level of changes.

First Job

According to job titles and responsibilities, coded by SOC Titles, 80 percent of the respondents were in engineering positions with the most common title being industrial engineer. An additional 9 percent were computer or systems analyst positions; 5 percent were in sales (sales engineer was common); 4 percent

[Respondent Profile]

Gender
68% Male

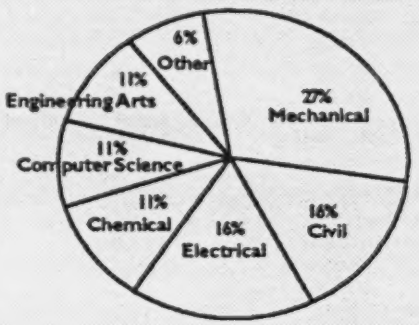
Median Age
31 Years

Marital Status
65% Married
32% Single
3% Other

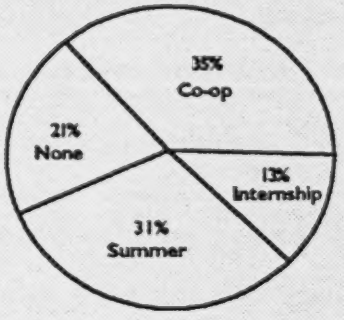
Children
38%

Degree Level
70% BS Engineering
17% MS Engineering
10% MBA
3% Ph.D. or Professional

[Engineering Disciplines Represented]



[Work Experience]



[Number of Organizations]

Only One	Average	Range
52%	1.87	1 to 8

[Number of Promotions]

None	Average	Range
19%	2.17	0 to 10

[Job Changes]

None	Average	Range
38%	1.33	0 to 15

[Job Responsibility Shifts]

None	Average	Range
45%	1.24	1 to 10

[Types of First Jobs]

Engineering
80%

Computer Analyst
9%

Sales
5%

Managers
4%

Other
2%

[Initial Point of Entry in Organization]

Entry Level
58%

2nd Level
22%

Higher Than 2nd
20%

were managers (including owners of their own companies); and 2 percent worked in a variety of other jobs such as an economist, lawyer, teacher, secretary, and health technologist. As expected, 56 percent of the respondents were initially employed by manufacturing firms, 13 percent by professional service firms, 10 percent by consulting organizations, and 9 percent by some government agency. The remainder were spread over a variety of different organizations. The size of firm employing these engineers varied from 50 to over 100,000 employees.

Were co-op engineers hired at a higher level in the organization than other engineers?

Most of the new entrants were assigned entry level positions as assistant engineers; a few at the slightly higher levels, specifically as associate engineers. The majority, 58 percent, started at the entry level and another 22 percent at the second level. The remaining 20 percent were hired into positions equivalent to a senior engineer, supervisor, managers, or owners of their own company.

Work experience did not appear to have an appreciable effect on the position the individual entered the organization, with the exception of engineers with three co-op experiences. Co-ops with three experiences were more likely to enter at the second level (29 percent) as compared to 20 percent for the other groups. Only 14 percent, however reported entering at higher organizational levels. This compared to 20 percent for all other groups.

Rephrasing the question, respondents were asked to count the levels of management beneath them in their first job. Seventy percent reported no management position below them, 18 percent with one level and the remaining 11 percent with two or more levels. Even those hired above the entry level found themselves in situations with no people below them in the organization. Consistent with the previous finding, engineers from both co-op groups were more likely to be in positions with no one underneath them than the engineers from the other three groups.

Two factors may explain this pattern of organizational entry: size of firm and engineering major. Co-ops with three experiences tended to be employed by firms with more than 1,000 employees. These firms were less likely to hire a new engineer at a position above the entry level. The accompanying table illustrates this point. Seventy-seven percent of co-ops with three experiences worked in firms with greater than 1,000 employees while the other four groups ranged from 54 to 68 percent. Yet, firms of this size only hired about 40 percent of the new engineers above the entry level. Smaller firms were closer to 50 percent.

Engineering major also influenced the starting level of new graduates. Among mechanical, electrical, and chemical, over half were employed by companies with more than 5,000 engineers. Civil engineering, computer science, and engineering arts graduates were more likely to find employment with firms of 1,000 or fewer employees. When compared by initial starting position, 62 percent of electrical and 66 percent of chemical entered at the entry level while mechanical, civil, computer science and engineering arts ranged from 54 to 58 percent.

A three-way comparison using major, work experience, and organizational entry level drew a more detailed picture. Among engineers with no work experience, all majors with the exception of chemical engineering had 60 percent or more of their graduates enter at the entry

[Work Experience and Company Size by Firms]

Firm Size	Distribution (%)					% Hired Above Entry
	No Experience	<2 Co-ops	>3 Co-ops	Interns	Summer	
<250	33	28	7	21	24	46
251-1,000	13	12	16	10	12	49
1,001-5000	20	25	27	12	18	42
5,000-100,000	23	25	34	31	33	37
>100,000	10	16	25	12	12	37

level. For chemical engineers the figure was only 50 percent with 33 percent entering at the second level. Among those with summer employment experiences, civil, computer science and engineering arts majors tended to enter at positions above entry level (approximately 70 percent). For mechanical and electrical engineers with internship experience, positions above entry level were the norm--only about 35 percent entered at the entry level. For the other majors with internships, the percentage at entry level was nearly twice as high. Among co-ops, those with two or fewer co-op terms experienced a pattern similar to summer employment : highest percentages at entry level, except for mechanical engineers. Engineers with three co-ops were found in entry level positions about 52 percent of the time. Electrical and chemical engineers, however, proved the exception with 60 percent and 77 percent, respectively, starting at the entry level.

The position an engineer accepts when admitted to an organization depends on two key factors: size of company and engineering discipline. Work experiences appeared to have little influence on the starting point in any meaningful way; although the evidence does suggest that co-ops and internships may afford some advantage to mechanical engineers, computer scientists, and engineering arts graduates.

Would graduates who had no work experience remain in their first position longer than other engineers? Would co-ops remain in their first position longer than other engineers, except those with no work experience?

These questions were based on the expectations that (1) with no prior experience, new labor force entrants would take more time to learn the ins and outs of the workplace while in their first job; and (2) with co-op experience, these entrants would be placed in more challenging positions that would keep their interest longer.

Co-ops were also assumed to possess a greater loyalty to their employer, having worked several years for the organization prior to full-time employment. This assumption did not stand up well as only 33 percent of these co-ops went to work for their co-op employer. The major reason co-ops failed to work for their employer was the unavailability of a position at graduation. Two additional reasons were also common responses: not interested in working for the co-op employer and a change in career interests that could not be satisfied by their co-op employer.

Results showed that the average tenure in the first job was 26.5 months or just over two years. For those respondents who were still in their

[Length of Tenure in First Job]

Overall Mean
26.5 months
Held Only One Job
40.4 months
Stayed Same Company
21.9 months
Leave Company
25.1 months

[Work Experience]

No Experience
32.9 months
<2 co-ops
26.4 months
>3 co-ops
28.5 months
Internships
22.8 months
Summer
23.4 months

[Entry into Labor Force]

1979-82
32.7 months
1983-86
29.1 months
1987-1990
21.5 months

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[Tenure in First Position by Change Position and Time in Labor Market]
(In Average Months)

	No experience	<2 Co-ops	>3 Co-ops	Interns	Summer
Position					
First Job	54.0	45.7	39.2	28.9	35.8
Same Company	25.5	17.6	24.3	19.9	20.6
New Company	27.3	28.7	29.9	18.7	21.5
Entry Into Labor Market					
79-82	46.5	31.7	34.0	21.1	24.8
83-86	32.6	34.9	29.9	29.7	24.5
87-90	24.5	16.2	22.8	22.9	20.3

first position, the length of time was slightly over 40 months; nearly twice the tenure of someone who had moved into a new position. If a respondent was promoted or changed jobs within the company, this usually took place after approximately 22 months on the job. Engineers accepting a new position in a new organization stayed in their first position about 25 months.

Significant tenure differences were found among the work experience groups. Those with no work experience stayed in their first job approximately 33 months; nearly a half-year longer than engineers in other groups. Among those with work experience, co-ops had a tenure of just over two years while the intern and summer employment group tenure was about half a year shorter, or slightly under two years.

Those in the no experience group who were still in their first job, had been in this position for four and a half years which was a longer tenure than other groups by a year or more. Co-ops who held only one position also stayed in their positions for a longer period, approximately three to four years. Interns and summer groups had the shortest tenure.

Movement within a company occurred between 18 and 25 months. Those with no experience and three or more co-ops remained the longest before moving to a new position. For those changing companies their moves occurred shortly after those who made internal moves, approximately 20 to 28 months. Again, those with no previous experience and co-ops made their moves after members of the intern and summer employment groups.

Because of changing labor market conditions, date of entry into the workplace was considered important. A labor market entry variable was created with those entering the labor market between 1979 and 1982 in group one, those from 1983 to 1986 in group two, and those from 1987 to 1990 in the third group. A dramatic shift in first position tenure occurred over the decade. The tenure of 33 months reported for the 1979 to 1982 group dwindled by nearly a year to 21 months for those entering between 1987 and 1990.

These patterns affected everyone, regardless of work experience. Still, significant differences appeared for those entering the labor force prior to 1982, the no work experience and all other groups and between co-ops (both groups) and the interns and summer employment groups. These significant differences disappeared in the later periods as all groups experienced marked decreases. Tenure for co-ops with three experiences, for example, dropped from 34 months to 30 months to 23 months over the decade. Those with no experience remained in their positions longer than all the other groups, but their tenure dropped by nearly two years.

Focusing on only those who had changed their position, an examination was made by date of labor market entry and work group. For those entering prior to 1982 and staying with their initial employer, tenure was approximately 24 months. Co-ops with three experiences who entered during this period stayed about 5 months longer, or 29 months, in their positions. For those who changed organizations during this period, tenure in their first position was longer by three months. The exception was co-ops with three experiences who stayed in their initial positions nearly a year longer than the others.

In the years between 1983 and 1986, the tenure patterns were similar to the previous period: movement within the same organization occurred at 24 months and a change to a new organization at 28 months. Co-ops shifted their tenure pattern, averaging 24 months in the same organization and 28 months before moving to a new company. This latter figure represented a drop of approximately 12 months. During this period, there was not much variation among work experience groups in their tenure patterns.

For those entering since 1987, tenure patterns really changed. Movement within the company occurred within 10 to 15 months for all groups except co-ops with three experiences who averaged 19 months. Switching to a new company occurred much sooner, dropping to between 14 and

17 months. Again both co-op groups tended to remain in their first position about 24 months before moving to a new employer. Even those with no work experience were making changes quickly during this period, generally around 14 months.

Did co-op graduates receive higher starting salaries than other engineers?

Co-op participants with three or more terms of experiences were found to have higher starting salaries than all other groups. The reported first salaries, adjusted to 1979 dollars, are listed to the right. The co-op group with three experiences group had significantly higher starting salaries than the groups with no work experience and summer employment. This group also maintained more than a $1,000 advantage over interns and the two-or-less co-op group.

In a regression of starting salaries, the difference in salary was largely explained by engineering major with mechanical, electrical and chemical as the leaders. Co-ops with three terms of experience still contributed significantly to the explanation of these differences after accounting for major (significance at .10).

When salaries were examined by time period, the largest difference between co-op participants and the other groups occurred in the 1979 to 1982 period. Their advantage continued into the 1983 to 1986 period, but the size of the differential decreased. Since 1987 salaries across all groups have been comparable; no one group stood out. The disappearance of the co-op salary advantage among recent graduates was also observed by Gardner et al (1992).

With prior work experience, would co-op graduates select a job that closely matched their employment expectations?

Because of their workplace experiences, co-op graduates were expected to evaluate their job opportunities and select a position more closely matched with their employment expectations. To determine if this was true, respondents rated fourteen work and organizational characteristics according to their desired importance in the job they wanted. Comparisons between 1990 graduates and all other years found no differences in ratings; thus reducing the potential for recall bias. These characteristics were rated similarly by all work groups, engineering majors, and date of entry into the workforce. The adjoining box highlights those characteristics that engineers considered to be the most important.

How well were initial expectations met on the first job? By comparing desired expectations against ratings of how well organizations and jobs provided the fourteen characteristics desired, the level of met or unmet expectations could be gauged. Overall, most respondents indicated that many of their expectations were unmet. No matter how the data were examined, unmet expectations predominated. Characteristics with significant differences between the desired and the actual levels included benefits, fit with outside interests (both exceeded expectations), challenging work, advancement opportunities, higher earnings and four other characteristics (all unmet expectations). Co-op participants were not spared from unmet expectations. Even with experience, co-ops expressed frustration that their jobs did not meet their expectations.

[Starting Salaries, Indexed to 1979]

Work Experience:

>3 Co-ops
$20,170
<2 Co-ops
$19,200
Internship
$18,910
Summer
$18,800
No Experience
$18,610

Engineering Major:

Mechanical
$20,540
Electrical
$20,260
Chemical
$19,930
Computer Science, Eng. Arts
$18,390
Civil
$16,480

[Highly Desired Job Characteristics]

- Opportunity to Improve Knowledge/Skills
- Challenging Work
- Advancement Opportunities
- Higher Earnings Potential
- Appreciation of Individual Accomplishments
- Friendly Co-Workers

Reaction to the Workforce

New entrants to the labor force envision that they will find certain conditions when they enter the workplace. They anticipate certain types of co-workers, the characteristics of their supervisors, the organizational work ethic, and other environmental stimuli. To determine how new engineers responded to their work environment, respondents were asked to evaluate nine dimensions of their first work environment. They were first asked to indicate whether they were surprised at their findings, the direction of their feelings (positive, negative, or neutral) and a brief description of these surprises.

Two areas received positive responses: the people they worked with and their own performance. They enjoyed their co-workers (at least the ones that were most like them), engineers, and other professionals who interacted with them. Their performance surprised them the most. They commented on how they quickly overcame their anxieties; they found they could perform the tasks assigned to them. They actually performed better than they expected. Of course, many qualified their performance by adding, "I had to learn to evaluate myself."

[Provision of Desired Characteristics in First Position]

☺More Than Expected

- Benefits
- Fit with Outside Interests

☹Less Than Expected

- Challenging Work
- Opportunity to Improve Knowledge and Skills
- Advancement Opportunities
- Higher Earnings Potential
- Appreciation of Individual Accomplishments
- Feedback
- Creativity

Two areas receiving about as many positive ratings as negative were training and supervisors. Training was either terrible (limited, useless, too much time for what was offered, did not match with job, focus too narrow, no opportunities to use) or very good (heavily emphasized, hands on, advanced technical, excellent trainers, challenging, broad in scope, and learned the organization). Good training targeted to the job assignment and providing insight into the organization actually set the overall tone for other dimensions they evaluated. New employees who were off to a good start were positive about the other dimensions of their work environment. Frequently, respondents commented that budget constraints limited or eliminated training programs which they felt was detrimental to their understanding their jobs and the organizations.

Similarly, their supervisors were either helpful and friendly; or they were absent, unfriendly, uninvolved, or unapproachable. According to the respondents, the supervisor plays an important role in bringing them onto the team. Not all supervisors could comfortably handle newcomers, which created barriers to newcomer assimilation. It took special people with excellent personal skills to welcome new employees and see that they were integrated into an environment where newcomers could be successful.

Four areas received fairly strong negative responses. New engineers were surprised at the poor quality of communication from supervisors and higher management within their organizations. Eighty-five percent harshly criticized their organizations' communications style. Communication was described as not well thought out, politically motivated, slow, and unprofessional. Transmitted in this fashion, messages were unclear and often conflicted. As a result new employees felt they were not informed about what was happening within their organizations.

The atmosphere of the work environment pleasantly surprised those who found themselves in organizations that were characterized as trusting, fun, friendly, supportive and professional environments. However, the majority of graduates were negatively impressed, finding a poor work ethic among employees, low expectations, competitiveness instead of teamwork, a lack of diversity, and unprofessional management. These environments were certainly not conducive to early career success.

Another feature that brought polar reactions was the nature of the work assignments. For positive respondents, approximately 30 percent felt their work assignments were challenging, technically oriented, interesting with diverse tasks, and offering a high level of responsibility (expectations were high). For the negative group, one word summed up how many felt about their jobs--boring. Dull, routine jobs were common; but making things worse was inconsistent direction from management, political interference that restricted productivity, low expectations, and the quantity of non-engineering work.

Personal lifestyle issues raised a number of concerns, particularly among co-op participants. While a few students were encouraged with their ability to adapt and become involved outside work, the majority found it hard to adjust from college. The lifestyle of college does not lend itself to the work environment, as graduates found themselves frustrated and tired. In their new environment, social life proved boring as it was difficult to develop friendships outside work. In fact work and associates at work dominated the life of some respondents; in other words, work became their life. Given the level of engineering salaries, it came as a surprise to learn that so many respondents had concerns over budgeting difficulties. Graduating students were unprepared to handle their financial resources or obligations; the burden of a new car, apartment, furnishings, and unexpected expenses; and other lifestyle support overwhelmed them.

[Workplace Reactions]

Nature of Work
- Challenging, Diverse
  Technical, High Responsibility
  vs.
- Boring, Routine, Political
  Non-Engineering Related

Organizational Atmosphere
- Relaxed, Trusting, Friendly
  Fun, Supportive, Professional
  vs.
- Poor Work Ethic, No Teamwork
  Unprofessional, Low Expectations

Communication
- Political, Slow, Unprofessional
  Not Well Thought-Out
  Conflicting, Secretive

Lifestyle
- Adaptable, Tolerant, Involved
  vs.
- Hard to Adjust, Stressful, Tiring
  Uncertainty About Future
  Budgeting Difficulties
  Lack of Social Life

Current Position

For this set of analyses, only respondents who reported at least one job change were included. Approximately 55 percent were still employed in the manufacturing sector and an additional 16 percent were now with consulting/professional services organizations. A shift occurred in job responsibilities according to job titles provided. Only 61 percent remained in engineering positions, usually as industrial engineers; 22 percent classified themselves as managers, including ten who owned their own businesses; 8 percent were computer analysts; 5 percent were in sales; and 4 percent were in various jobs including attorneys, teachers, health service professionals, economists, statisticians, and financial analysts.

A noticeable shift was the movement to smaller firms. Those working for organizations with fewer than 250 employees grew by 4 percent. Most of this gain was a result of engineers leaving the largest organizations which experienced a decrease of 5 percent (total for organizations larger than 1000 employees).

[Size of Firm]

Firm Size	% First Position	% Current Position	% Change
<250	22	26	+4
251-1,000	13	14	+1
1,001-5000	22	20	-2
5,000-100,000	30	29	-1
>100,000	13	11	-2

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[Current Level In Organization]

No Experience
3.05
<2 Co-ops
2.77
>3 Co-ops
3.06
Internships
2.52
Summer
3.39

(A "3" is equivalent to a senior engineer)

[Current Salaries]

Work Experience:

>3 Co-ops
$48,610
Internship
$47,420
Summer
$47,380
<2 Co-ops
$45,570
No Experience
$44,900

Engineering Discipline:

Chemical
$49,720
Civil
$47,460
Mechanical
$47,220
Electrical
$46,040
Computer Science, Eng. Arts
$45,940

Have co-op graduates moved to higher organizational levels, such as managers?

Results from ANOVAs compared work group by level in the organization revealed no significant differences. Co-ops with three experiences had moved to the third level or senior engineer level; other groups had achieved similar results, except for interns who were one level behind. When examined by time in the labor force, co-ops did not stand out in any special way. One characteristic that distinguished co-ops with three experiences from the other groups was the high percentage (50 percent) who worked for the larger organizations.

Factors that affected the level within organizations were engineering major and number of positions held. Mechanical and electrical engineers were more likely to appear at lower levels than other engineering majors. This relationship was significant ($F = 4.153$, p .003). This pattern held regardless of the year when the engineers entered the labor force. Organizationally, size again played an important role as mechanical and electrical engineers tended to be concentrated in the larger companies.

Persons who had held more positions had moved further up the organizational ladder. For example, if an engineer was in his or her second position, they were at the third level; by the fifth position, the engineer was at level five or in a management position.

Did the salary advantage remain with co-ops as they moved up?

Co-ops with three experiences received higher salaries in their current positions than all other groups. The differences in average salary between co-ops with three experiences and co-ops with two and no work experience was significant. This pattern prevailed over all periods of labor market entry.

An interesting finding was the absence of significant salary differences among engineering disciplines. Chemical and civil engineers made nice gains to catch and surpass mechanical and electrical engineers. Engineering arts and computer scientists also closed the gap, remaining only about $1,000 behind electrical and mechanical majors.

The relationship between current salary, adjusted to 1979, and initial salary provided insight into the growth of salary over time for the 1979 to 1982 labor market group. The annual salary growth for co-ops was a modest 3.6 percent per year. This allowed the co-op group to maintain its salary advantage. Only salaries of those with "no experience" grew at a slower rate. Interns saw annual gains of approximately 8 percent while co-ops with two experiences and summer employment advanced at between 5 and 6 percent per year.

Did moving into a new job result in a better alignment of expectations?

In many respects, a better match between expectations, actual work and organizational characteristics can be anticipated as engineers shift into new positions. These moves are predicated on maximizing desired work

[Comparison of Initial and Current Salary & Salary Growth]
(For 1979-82 Labor Market Group — Indexed to 1979)

Work Experience	Initial ($)	Current ($)	Change (%)	Annual Change (%)
No Experience	20,650	26,360	28	3.0
<2 Co-ops	18,250	29,670	62	6.5
>3 Co-ops	21,730	30,730	41	4.3
Internship	17,220	31,400	82	8.6
Summer	19,370	29,380	51	5.4

characteristics. Repeating their ratings on how well their current job matched their expectations, respondents reported their current position still provided more "somewhat important" characteristics, fringe benefits, and fit with outside interests, than originally expected; plus more opportunities to express their creativity and greater interaction with quality upper management. The number of characteristics where expectations remained unmet actually decreased. However, key desires, including challenging work, advancement opportunities, and ability to obtain higher earnings were still less than expected.

Co-ops with less than two experiences and interns made better adjustments. Co-ops with more than three experiences reported more unmet expectations than the others. For them four features stood out: unfulfilled desire for higher earnings, lack of challenging work, few advancement opportunities, and little feedback on performance. Those with no work experience also rated higher earnings as an unmet desire. The feelings of these two groups relate to the growth of pay shown above: these two groups experienced the lowest annual gains in salary.

Other observations emerging from these ratings illustrated how different engineering majors fared when they changed jobs. Civil engineers were better able to bring their expectations into alignment while mechanical engineers, computer scientists, and engineering arts graduates had the most difficulty. Mechanical engineers, in particular, found their work unchallenging and without advancement opportunities.

Graduates who have been in the workforce longer had more positive adjustments; but still remain unfulfilled in terms of advancement opportunities and higher earnings potential. The newest entrants, as would be expected, were still having problems matching their expectations and work characteristics.

An interesting relationship was found when comparing individuals who change to a new organization with those who remain with their first employer. Simply changing positions did not immediately improve things. Those who moved internally within organizations did not appreciably improve the match between their desired and actual work characteristics. For those who moved to a new company, expectations were fulfilled in these areas: more challenging work, clearly specified tasks, and higher quality senior management.

[Satisfaction with Current Position]

☺
- Benefits
- Creativity
- Quality of Senior Management

☹
- Challenging Work
- Higher Earnings
- Advancement Opportunities
- Improved Knowledge/Skills

Interfacing Education and Work

University graduates leave their institutions with a bundle of skills, experiences and relationships to be utilized, molded and enhanced by their activities and interactions in the "real world." How well are students prepared to handle the tasks thrown at them in the workplace? Respondents answered two open-ended questions, commenting on areas their college education prepared them and in areas their education failed to provide them skills or insights required for their jobs.

Responses were categorized using content analysis. Each respondent was allowed up to three answers per question. A long list for each question evolved. Nearly 45 percent of the responses praised their education for providing them with sound problem-solving skills. Engineers believed they were well trained in the technical skills of engineering, programming, and report writing. The demands of their curriculum instilled in them a sense of discipline, which translated into a strong work ethic.

[Undergraduate Program Evaluation]

Strengths
- Problem Solving Skills
- Technical Skills
- Programming
- Report Writing
- Discipline/Work Ethic

Weaknesses
- Oral Communication Skills
- Written Communication Skills
- Application to Real World Situations
- Integration with Business Operations
- Interpersonal/Teamwork Skills
- Leadership/Management Skills

The shortcomings of their education were more diffuse with a range of responses that were condensed to six key factors. Oral communication skills were the most frequently mentioned as shortcomings, followed closely by written communication skills. Two closely related areas dealt with applications of engineering to real world situations. Graduates expressed concern that their theoretical training did not prepare them well for the applied nature of the work they performed. Similarly, they expressed frustration in merging engineering tasks with general business operations. In other words, they were good engineers; but they did not understand how the business environment functioned.

The final group of shortcomings concerned interpersonal (teamwork) and leadership skills. Graduates articulated a greater need to be involved in team building exercises while in school. Many failed to realize how soon they would be expected to demonstrate leadership and management skills.

Discussion

This study was designed to probe into the career paths of engineers who had recently entered the labor market with the intention of comparing the outcomes of co-op participants with other engineers. As the various layers enveloping the careers of engineers were pulled back, co-op experiences appeared to have little influence on career progress in comparison to other work experiences. Co-ops entered at the same level and were promoted at approximately the same pace as all other engineers. The size of the organizations entered by co-ops certainly explained some of what happened. However, Cowan's interpretation of the early careers of engineers may well be accurate. A number of engineers reported being in school or thinking strongly about returning soon: all jockeying for a better position on the career ladder.

Co-ops did excel in one area--salary. Co-ops maintained their

salary advantage over all time periods studied, even though the salary gap appeared to be closing. In fact, it is the salary advantage that may be affecting how fast co-ops move to new positions. When looking at a new position, an individual usually seeks a salary enhancement as an inducement to move, all other things being equal. The jobs that are initially available may not be monetarily attractive to co-ops while they were to those at lower salaries. Thus, those who start at lower salaries can experience more growth in salary plus faster movement than co-ops. When co-ops moved, the percentage gained was smaller but the actual incremental change was large. Salaries have a strong influence on early career patterns: those with higher starting salaries stay longer in positions.

A close examination of those who entered the labor force between 1979 and 1982 suggested that co-ops were beginning to pull ahead in terms of management level assignments. This pattern may be an anomaly of this particular group of engineers; but it may also suggest that between seven and ten years after graduation when companies begin to select their management staff co-ops are being tapped more often. Because of this timeline, there may be a long delay before co-op experience affects the career process.

More likely, however, the patterns that emerged over the time periods used in this study reflect the changing structure of the economy. The loss of the hierarchical organization, replaced by a web of interlocking smaller firms, has not translated into a similar change in the hierarchical progression of careers. In order to move a career forward in a web structure, a worker needs to change positions on a more frequent basis. This is especially true if the goal is to receive higher pay, to gain new skills, and to be more creative. Employment contracts are also being altered, especially concerning longevity, unemployment, and team membership, for example. Team membership also requires a change in perspective from strictly technical, functional activities to the broader range of processes in the organization. This is because teams incorporate people representing different areas in order to more efficiently produce for and provide service to customers. Thus employees interact with a variety of people whom they must communicate. The non-hierarchical pattern of the workplace requires changes in work expectations in order for workers to develop their careers.

Engineers who graduated between 1979 and 1982 have careers that mirror the hierarchal structure. They have steadily moved up and are now in management. They have changed companies but just as often as those coming after them, indicating that they do it much less frequently. This period preceded the major organizational restructurings that began by the mid 1980s. The group from 1983 to 1986 reflect mixed experiences: with some obviously caught up in the restructuring, actually commenting on this fact; while others were nestled in hierarchical organizations with careers moving along in the traditional fashion. For those graduating since 1986, when restructuring gained momentum and the new economy began to emerge, careers were swirling or in constant motion. Movement to new positions was much faster; expectations and realities were separated by a chasm, and uncertainty about employment was paramount. For this group, the world has really changed, and they are caught up in it.

In light of these changes, it is not surprising to find engineers having difficulty shedding their hierarchical career plans. While they shifted jobs to better match their expectations, many "very important" expectations remained unmet. With the exception of challenging work, the ability of an organization to meet these expectations may be limited. This problem is compounded for co-ops because of a tendency to remain in a position longer than they should, even if salary imposes limitations. Movement through the web does garner rewards for those who have changed.

Those engineers who were involved in internships may have acquired skills useful in today's economy. Since no formal intern program exists on this campus, students seeking interns must do so on their own. In the pursuit of their internships, these engineers develop entrepreneurial skills that permit them to navigate in today's complex labor market. These are valuable skills; skills other engineers do not have when they graduate.

The group that is most disadvantaged in the labor force is those engineers who gained no relevant work experience prior to graduating. If there was any strong message in these results, work experience (no matter how it is arranged) pays off handsomely. For those with no work experience, salaries remained low, and promotions were not as frequent. The learning time in the first job appeared considerably longer for those without experience. Every engineering major should be required rather than encouraged to gain appropriate experiences before leaving school.

Most college recruiters will confide that many of the jobs that beginning engineers will enter are boring. Yet the graduates do not believe they will be in boring jobs. The message, while being recruited, is one of excitement. Yet many engineers described their jobs as dull, routine, and boring. Recognizing that there are a number of routine jobs that have to be filled, employers need to better match candidates with available positions. If employers seek the "stars" for every position, a potential situation is created where some new engineers will be very unhappy. This could lead to extinguishing the fires (enthusiasm, creativity) that engineers have when leaving college, and to an early exit from the organization.

Co-ops who through focused work experiences have gained an understanding of the workplace appeared particularly frustrated by the lack of challenge in the work they undertook. This was not as they expected; in fact several commented that the work they performed was similar to their

co-op assignments. They had expectations to grow beyond this point much sooner than they had. This was disconcerting because it suggested that these human resources, often cited as critical to our national competitiveness, were being underutilized.

An area which needs additional exploration concerns the problems that graduates had in adjusting to the world away from college. Why do co-op students express more concern over their ability to make new friends; develop a life outside work, and to budget their resources wisely? Is it possible that co-op students missed opportunities to develop social skills by their absence from campus? Probably not, as findings from other student surveys indicate that other graduates have the same problems. Socializing in college has its own milieu, which is very different than the environment that surrounds the work environment. Following a social agenda similar to that in college can lead to conflicts in the workplace. An employee can neither come in tired on Monday, nor skip a day like in college. It is a challenge to achieve a balance between work and outside activities. The tendency is to make work all-consuming which soon leads to stressed and frustrated individuals. Attention needs to be given to this issue as well as the other lifestyle issues prior to graduation. Whether it is through a senior year capstone course or a set of workshops, graduating seniors need to be more aware of some of the choices to be made and the non-academic skills required to adjust to the transition.

This study, despite its shortcomings, presents useful insights into the early work experiences of engineers. These engineers may not be typical of other engineering students, primarily because so many have been drawn to the automotive industry: an industry continuing to undergo enormous change. These changes have affected the early career patterns of many engineers. This sample was also not representative of other co-op programs that provide service to different academic majors. Graduates from these programs may have other experiences. The cross-sectional design also presents problems when interpreting events across time. Ideally, a longitudinal study would be more appropriate to measure these type of changes. With the world's changing economic structure, important factors that are currently affecting careers may have been omitted from the survey. However, the willingness of these engineers to provide so much information about their careers offers encouragement for continuing studies on these important issues.

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